

$$f = 75\text{KHz}$$

$$T = \frac{1}{f} = \frac{1}{75 \times 10^3} = 13.33\mu\text{sec}$$

Now

$$T = T_1 + T_2$$

$$T_2 = T - T_1 = 13.33 - 2$$

$$= 11.33\mu\text{sec}$$

$$T_1 = 0.69R_1C_1$$

$$2 \times 10^{-6} = 0.69 \times 10 \times 10^3 C_1$$

$$C_1 = 289.85\text{pF}$$

$$T_2 = 0.69R_2C_2$$

$$11.33 \times 10^{-6} = 0.69 \times 10 \times 10^3 C_2$$

$$C_2 = 1.642\text{nF}$$

**Example 4:** If  $R_1 = 10\text{K}\Omega$  and  $R_2 = 5\text{K}\Omega$  and  $C_1 = C_2 = 0.1\mu\text{F}$ , find the frequency and duty cycle of the astable output.

**Solution:**

$$T_1 = 0.69R_1C_1 = 0.69 \times 10 \times 10^3 \times .1 \times 10^{-6}$$

$$= 0.69\text{msec}$$

$$T_2 = 0.69R_2C_2 = 0.69 \times 5 \times 10^3 \times .1 \times 10^{-6}$$

$$= 0.345\text{msec}$$

$$T = T_1 + T_2 = 1.035\text{msec}$$

$$f = \frac{1}{T} = \frac{1}{1.035 \times 10^{-3}}$$

$$= 966.18\text{Hz}$$

$$\text{Duty cycle} = \frac{T_2}{T_1 + T_2} = \frac{0.345}{0.69 + 0.345}$$

$$= 0.33 = 33.3\%$$

#### 4.11 Two Marks Question and Answers

1. What is High pass RC circuit? Why it is called high-pass filter?
  - i. A simple circuit consisting of a series capacitor and a shunt resistor is called high pass RC circuit.
  - ii. At very high frequencies the capacitor acts as a short circuit and all the higher frequency components appear at the output with less attenuation than the lower frequency components. Hence this circuit is called high-pass circuit.
2. Why high-pass RC circuit is called Differentiator?
 

High-pass RC circuit gives an output waveform similar to the first derivative of the input waveform. Hence it is called Differentiator.
3. What is Low pass RC circuit? Why it is called low-pass filter?
  - i. A simple circuit consisting of a series resistor and a shunt capacitor is called Low pass RC circuit.
  - ii. At very high frequencies the capacitor acts as a virtual short circuit and output falls to zero. Hence this circuit is called low-pass filter
4. Why low-pass RC circuit is called Integrator?

Low pass RC circuit gives an output waveform similar to the time integral of the input waveform. Hence it is called Integrator.

5. What is High pass RL circuit? Why it is called high-pass filter?
  - i. A simple circuit consisting of a series resistor and a shunt inductor is called high-pass RL circuit.
  - ii. At very high frequencies, the inductor acts as an open circuit and all the higher frequency components appear at the output. Hence this circuit is called high-pass filter.
6. What is Low pass RL circuit? Why it is called low-pass filter?
  - i. A simple circuit consisting of a series inductor and a shunt resistor is called low pass RL circuit.
  - ii. At very high frequencies, the inductor acts as a virtual open circuit and the output falls to zero. Hence this circuit is called low pass filter.
7. What is Rise time ( $t_r$ ) in transistor?

The time required for the collector current to rise from 10% to 90% of the maximum value is called rise time ( $t_r$ ).
8. What is storage time ( $t_s$ ) in transistor?

The time when collector current ( $i_c$ ) dropped to 90% of its maximum value is called the storage time.
9. What is fall time ( $t_f$ ) in transistor?

The time required for the collector current to fall from 90% to 10% of its maximum value is called fall time ( $t_f$ ).
10. What is clipper?

The circuit with which the waveform is shaped by removing (or clipping) a portion of the input signal without distorting the remaining part of the alternating waveform is called a clipper.
11. What are the four categories of clippers?
  1. Positive clipper
  2. Negative clipper
  3. Biased clipper
  4. Combination clipper
12. What is comparator?
  - i. The nonlinear circuit which was used to perform the operation of clipping may also be used to perform the operation of comparison is called the comparator.
  - ii. The comparator circuit compares an input signal with a reference voltage.
13. What is clamper?

A circuit which shifts (clamps) a signal to a different dc level, i.e. which introduces a dc level to an ac signal is called clamper. It is also called dc restorer.
14. Which circuits are called multivibrators?
  - i. The electronic circuits which are used to generate nonsinusoidal waveforms are called multivibrators.
  - ii. They are two stage switching circuits in which the output of the first stage is fed to the input of the second stage and vice-versa.
15. Which are the various types of multivibrators?
  - i. Astablemultivibrator
  - ii. Bistablemultivibrator
  - iii. Monostablemultivibrator
16. What is astablemultivibrator?

- i. A multivibrator which generates square wave without any external triggering pulse is called astable multivibrator.
  - ii. It has both the states as quasi-stable states. None of the states is stable.
  - iii. Due to this, the multivibrator automatically makes the successive transitions from one quasi-stable state to other, without any external triggering pulse. So it is called Free-running multivibrator.
  - iv. The rate of transition from one quasi-stable state to other is determined by the discharging of a capacitive circuit.
17. List the applications of Astable multivibrator?
  - i. Used as square wave generator, voltage to frequency converter and in pulse synchronization, as clock for binary logic signals, and so on.
  - ii. Since it produces square waves, it is a source of production of harmonic frequencies of higher order.
  - iii. It is used in the construction of digital voltmeter and SMPS.
  - iv. It can be operated as an oscillator over a wide range of audio and radio frequencies.
18. State the basic action of monostable multivibrator.
  - i. It has only one stable state. The other state is unstable referred as quasi-stable state.
  - ii. It is also known as one-shot multivibrator or univibrator.
  - iii. When an external trigger pulse is applied to the circuit, the circuit goes into the quasi-stable state from its normal stable state.
  - iv. After some time interval, the circuit automatically returns to its stable state.
  - v. The circuit does not require any external pulse to change from quasi-stable state.
  - vi. The time interval for which the circuit remains in the quasi-stable state is determined by the circuit components and can be designed as per the requirement.
19. Mention the applications of one shot multivibrator?
  - i. It is used to function as an adjustable pulse width generator.
  - ii. It is used to generate uniform width pulses from a variable width pulse train.
  - iii. It is used to generate clean and sharp pulses from the distorted pulses.
  - iv. It is used as a time delay unit since it produces a transition at a fixed time after the trigger signal.
20. Which multivibrator would function as a time delay unit? Why?

Monostable multivibrator would function as a time delay unit since it produces a transition at a fixed time after the trigger signal.
21. What is Bistable multivibrator?
  - i. The Bistable multivibrator has two stable states.
  - ii. The multivibrator can exist indefinitely in either of the two stable states.
  - iii. It requires an external trigger pulse to change from one stable state to another.
  - iv. The circuit remains in one stable state unless an external trigger pulse is applied.
22. List the applications of bistable multivibrator?
  - i. It is used as memory elements in shift registers, counters, and so on.
  - ii. It is used to generate square waves of symmetrical shape by sending regular triggering pulse to the input. By adjusting the frequency of the trigger pulse, the width of the square wave can be altered.

- iii. It can also be used as a frequency divider.
- 23. What are the two methods of triggering for bistable multivibrators?
  - i. Unsymmetrical triggering
  - ii. Symmetrical triggering
- 24. What are the different names of bistable multivibrator?

Eccles Jordan circuit, trigger circuit, scale-of-2 toggle circuit, flip-flop and binary.
- 25. What are the other names of monostable multivibrator?

One-shot, Single-shot, a single-cycle, a single swing, a single step Multivibrator, Univibrator.
- 26. Why is monostable multivibrator called gating circuit?

The circuit is used to generate the rectangular waveform and hence can be used to gate other circuits hence called gating circuit.
- 27. What is the other name of astable multivibrator- why is it called so?

As it does not require any external pulse for transition, it is called free running multivibrator.
- 28. What are the other names of speed up capacitors?
  - i. Commutating capacitors
  - ii. Transpose capacitors
- 29. Define gate width

The pulse width is the time for which the circuit remains in the quasi stable state. It is also called gate width.
- 30. What is Schmitt trigger?
  - i. It is a wave shaping circuit, used for generation of a square wave from a sine wave input.
  - ii. It is a bistable circuit in which two transistor switches are connected regeneratively.
- 31. What is meant by hysteresis voltage in a Schmitt trigger?
  - i. The difference between UTP (Upper Threshold Point) and LTP (Lower Threshold Point) is called hysteresis voltage ( $V_H$ ).
  - ii. It is also known as Dead Zone of the Schmitt trigger.
- 32. List the applications of Schmitt trigger.
  - i. It is used for wave shaping circuits.
  - ii. It can be used for generation of rectangular waveforms with sharp edges from a sine wave or any other waveform.
  - iii. It can be used as a voltage comparator.
  - iv. The hysteresis in Schmitt trigger is valuable when conditioning noisy signals for using digital circuits. The noise does not cause false triggering and so the output will be free from noise.